UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 145 TO FACILITY OPERATING LICENSE NO. DPR-72

FLORIDA POWER CORPORATION, ET AL.

CRYSTAL RIVER UNIT NO. 3 NUCLEAR GENERATING PLANT

DOCKET NO. 50-302

1.0 INTRODUCTION

By letter dated June 13, 1991, as supplemented November 6, 1991, Florida Power Corporation (the licensee) requested revisions to Technical Specifications (TS) Section 3/4.6.2.2 and the related Bases of Facility Operating License No. DPR-72 for the Crystal River Unit 3 (CR-3) Nuclear Generating Plant. The proposed revisions would delete the specification for a sodium hydroxide (NaOH) spray additive, and would replace it with a specification for the use of trisodium phosphate dodecahydrate (TSP-C) as the chemical for pH control. The change in water treatment is being requested based on research and operating experience that has demonstrated that a plain borated water mixture used in a containment spray system is effective in removing elemental iodine during the initial injection phase after a loss-of-coolant accident (LOCA). However, a buffering agent like TSP-C is needed during the recirculation phase to preclude re-evolution of the iodine and to control the long-term corrosion problem. These goals are achievable at a pH level above 7. Also, the proposed changes in the chemical and method of application are expected to reduce operational problems and personnel hazards. The November 6, 1991 letter provided supplemental information that did not change the initial proposed no significant hazards consideration determination.

2.0 EVALUATION

Current TS requirements achieve pH control of the containment emergency sump spray by the addition of NaOH to the reactor building spray during the initial phase of a LOCA. The NaOH-treated coolant from the borated water storage tank (BWST) is then sprayed into the containment atmosphere. The treated coolant exiting from the ruptured pipe then enters the containment emergency sump. The treated coolant and the discharge into the sump are expected to have a pH in the range of 7.2 to 11.0. This pH range would be present in the sump to prevent iodine re-evolution and protection for long-term stress corrosion.

During the injection phase, the licensee has proposed to operate the containment sprays with borated water without NaOH additive. This borated water could have a pH level lower than 7. Recent research results documented in Revision 2 of Standard Review Plan (SRP) Section 6.5.2, "Containment Spray As A Fission Product Cleanup System," addressing iodine removal, demonstrate

that a low pH value would not affect the removal rate of the elemental and particulate iodine from the post-LOCA containment atmosphere.

These rates are determined by the first-order removal coefficients, which for elemental iodine removal by spray water and by disposition on the containment walls are independent of pH and, therefore, are not affected by elimination of the pH controlling additive. The same applies to the removal coefficient for particulate iodine which is controlled by the hydrodynamic characteristics of the spray.

The licensee has evaluated their proposed deletion of the NaOH additive prior to the post-LOCA recirculation phase of the emergency core cooling systems (ECCS) utilizing the information in Revision 2 of SRP Section 6.5.2, and has determined that the iodine removal rate of a plain boric acid spray is high enough to make a spray additive unnecessary during the initial injection phase, when the spray solution is being drawn from the BWST. The staff has evaluated the proposed TS change and related justification utilizing the recent research results documented in SRP Section 6.5.2, Rev. 2. Based on this evaluation, the staff finds the above change acceptable.

During the recirculation spray phase, coolant from the sump will contain dissolved iodine removed from the containment atmosphere during the injection phase. In a radiation environment this iodine could be desorbed from the water and released to the containment atmosphere if the pH of the sump solution is too low. Maintaining the pH solution above 7 would prevent this undesirable condition.

The licensee has proposed to control the pH above a level of 7 by the addition of the containment emergency sump pH control system. This is a passive system utilizing three stainless steel storage baskets filled with TSP-C. These mesh screen baskets would be anchored at the 95-foot elevation utilizing stainless steel anchors. The system is designed to withstand seismic loads. The baskets are positioned in the flow path of the reactor building spray (RBS) system and reactor coolant mixture flowing to the emergency sump.

The design assures adequate dissolved TSP-C in the water by considering the flow path and the area. Further, the licensee's analyses have considered a range of quantities for boric acid and TSP-C with various dissolving times. The minimum pH would be produced by the maximum amount of boric acid, the minimum amount of TSP-C, and the longest dissolving time. Conversely, the maximum pH would be produced by the minimum amount of boric acid, the maximum amount of TSP-C, and the longest dissolving time. The licensee has established as a requirement that 250 ± 4 cubic feet of TSP-C will produce a pH range between 7.0 and 7.6 at the onset of the recirculation phase and therefore will create the desired pH level in the system. The staff has evaluated the criteria utilized by the licensee that assures a pH level above 7.0 and finds it acceptable based on previous evaluations for other operating power plants.

The sump water must also be maintained in the alkaline condition in order to minimize corrosion of metallic surfaces. Chloride-induced stress corrosion cracking of austenic stainless steel components is considerably reduced if the pH of the solution is maintained above 7. However, short exposure to water with a pH below 7 during the injection phase will not cause significant stress corrosion cracking, but more extended exposure during the recirculation phase or in the sump may result in significant damage. The pH proposed during the injection and the recirculation phases (4.5 to 5.5 and 7.0 to 7.6, respectively) will have no significant effect on the materials in the RBS and reactor coolant system since these materials are either resistant or protected by corrosion-resistant coatings. Also, Section 6.1.1 of the SRP (Branch Technical Position MTEB 6-1) recommends that the pH be maintained in the 7 to 9.5 range. The range proposed by the licensee satisfies this guideline.

Control of the sump pH is also required to minimize hydrogen generation by corrosion of aluminum and zinc on galvanized surfaces and in the inorganic coating on the containment surfaces. Other licensees have demonstrated to the staff that the proposed lowering of the pH for the spray will have no significant effect on the corrosion of aluminum as long as the pH remains above 4.5. Zinc in paints and in organic coatings will corrode and produce hydrogen. However, the results of NRC-sponsored studies performed by Sandia National Laboratory demonstrate that with a controlled pH the corrosion rate will be low and no significant amounts of hydrogen will be produced. The operating conditions proposed by the licensee would preclude any unfavorable conditions.

TSP-C is being used in similar passive systems at several operating nuclear power plants. The proposed pH levels have been determined to have no significant effect on the removal of elemental and particulate iodine from the post-LOCA containment atmosphere. Also, the potential for stress corrosion and the hydrogen generation have been evaluated and dismissed as potential threats to the plant components by study of the pH levels. The staff has reviewed the proposed changes, the licensee's assessment, and the staff SRP positions. The staff agrees with the licensee's assessment, and finds the proposed TS changes acceptable.

3.0 STATE CONSULTATION

Based upon the written notice of the proposed amendment, the Florida State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

This amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined

that the amendment involves no significant increase in the amounts, and no significant change in the types of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that this amendment involves no significant hazards consideration and there has been no public comment on such finding (56 FR 33955). Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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